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ABSTRACT

The levels of processing framework for understanding memory development has generated little empirical or theoretical work that furthers an understanding of the developmental memory system. Although empirical studies by those testing the levels of processing framework have demonstrated that mnemonic strategies employed by children are the critical component of memory performance, this result is not dependent on a levels of processing formulation. It also does not clarify the three critical issues in understanding the developing memory system: what the particular mechanisms are that might operate in the different rehearsal strategies; the importance of the structures and content of the knowledge base; and apparently involuntary memory processes such as those involved in attention, pattern recognition, and memory inferencing. (TJ)

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Developmental Implications of the Levels of Processing Memory Framework

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During the last five years the levels of processing framework has had a major impact upon investigations of the development of memory in children. As indicated by any quick survey of the developmental literature, many recent investigations of memory development refer to the levels of processing framework in general terms and/or assert that their data either "are or are not consistent with" this approach. Unfortunately, however, a closer examination of the research which has been generated from this framework suggests that despite its initial promise and its very broad impact and appeal, the levels of processing view of memory seems to have generated little empirical or theoretical work which furthers our understanding of the developing memory system.

Empirical Work. In the most simplistic terms, the levels of processing framework makes a rather staightforward but quite interesting prediction for developmental investigations of memory; namely, that the information which a child remembers will be a direct function of the type of memory processing in which he engages during learning regardless of his age or his intention to remember. This prediction suggests that the developmental differences observed in memory performance in a variety of laboratory memory tasks are a direct result of age-related differences in the mnemonic processing in which children of different ages spontaneously engage.

Within the levels of processing framework a number of experiments have been conducted to test this notion. When Geis and Hall (1976) tested first, third, and fifth graders in an incidental memory paradigm, for example, they found that recall performance was completely determined by the type of mnemonic strategy suggested during the incidental task. For children of all ages, a semantic incidental learning task resulted in superior recall than either an acoustic or orthographic encoding task. Similarly, Murphy and Brown (1975) demonstrated that preschoolers recall performance in an incidental learning task requiring comprehension was equivalent to that which results when the children were performing in a deliberate memory task. Both of these findings demonstrate that, regardless of age or task demands, processing

activity determines remembering.

Although this conclusion is quite interesting, it is not specifically dependent upon the levels of processing framework. In fact, during the past ten years, quite independent of the levels of processing formulation, the major finding in the developmental investigations of memory has been that age-related changes in memory performance are directly related to developmental differences in children's abilities to efficiently use mnemonic strategies. In our own laboratory, for example, Peter Ornstein and I have been investigating the role of rehearsal processes in memory development (Ornstein, Naus & Liberty, 1975; Naus, Ornstein & Aivano, 1977; Naus, Ornstein & Kreshtool, 1977; Ornstein, Naus & Miller, 1977; Ornstein, Naus & Stone, 1977; Ornstein & Naus, 1978). Whereas studies in the levels of processing tradition have typically varied encoding strategies indirectly by manipulating instructions or task demands, we have used a modification of Rundus' (1971) overt rehearsal procedure to measure and manipulate rehearsal strategies directly.

We have shown that developmental differences in recall performance are directly related to age-related changes in the encoding strategies employed by children. Whereas third graders rehearse in a passive fashion repeating each presented item either alone or in minimal combination with other list items, older children rehearse more actively by practicing several, often semantically related, items together as each word in the list is presented. Further, by using instructed rehearsal techniques we have demonstrated that the relationship between rehearsal activity and recall performance is not simply corelational, but that the extent of rehearsal activity directly determines recall performance. Older children instructed to rehearse in a passive, single-item fashion showed levels of recall similar to those of spontaneously passively rehearsing younger children. Similarly instructing younger children in active rehearsal improved their recall to nearly the level of the older children who employ this strategy spontaneously. Although these investigations of the development of rehearsal strategies in children were conducted independent of the levels of

processing framework, this work also clearly demonstrates that mnemonic strategies are the critical component of memory performance. Regardless of developmental level or task demands, it is the encoding strategy employed by the child which determines the level of memory performance. Thus, the developmental investigations of incidental learning under various encoding instructions based on the levels of processing formulation described above seem to add little to our understanding of the role of mnemonic processing in the development of memory beyond that which has been studied in the direct investigations of verbal rehearsal.

Theoretical Issues. Further, and perhaps more importantly, quite possibly because the levels of processing theory is somewhat general and developed primarily to address questions of adult memory processing, it does not help to clarify what seem to be the three critical issues in our understanding of the developing memory system. First, as pointed out above, while many of the studies investigating memory and development both within and outside the levels of processing formulation have demonstrated the direct relationship between encoding processing and recall performance in children, none of the current work begins to suggest the particular mechanisms which might operate in the different rehearsal strategies. Like other current models of memory, the levels of processing formulation is primarily descriptive and merely suggests a direct relationship between encoding strategy and remembering. Unfortunately, in its present form it does not propose either the mechanisms which might be involved in the more effective recall resulting from active rehearsal or in the spontaneous development of active rehearsal processes with age.

Second, developmental psychologists have recently begun to recognize the importance of the structure and content of the knowledge base in developmental differences in memory performance. In addition to age-related differences in mnemonic processes such as rehearsal, developmental differences in children's knowledge about the world seem to account for the age-related differences often observed in memory tasks. In a recent study in our laboratory, for example, we have demonstrated the importance of the knowledge base in determining recall performance. Second and sixth graders

were compared in their visual memory for toy animals in a zoo construction and for chess pieces displayed on a chess board. Children were asked to rehearse overtly when studying either material. For the knowledge base manipulation, half of the children at each grade were selected for their inexperinece in chess, whereas half were selected for their expertise in chess. Both rehearsal and recall data for the animal and chess configurations were compared for the experts and nonexperts at each grade level. Rehearsal patterns did not differ for learning the animal or chess configurations. As expected, for both the chess experts and nonexperts, the second graders practiced the to-be-remembered animal and chess configurations in a passive, single-item fashion, whereas the older children rehearsed actively, practicing several proximal items together. The pattern of the recall data, however, differed for the two types of visual materials. For the animal configurations, as would be expected on the basis of the rehearsal data, there were no differences in recall between the chess experts and nonexperts at either grade level, and the sixth graders recalled more than the second graders. In contrast, for the chess configurations there were major differences in recall between the experts and nonexperts across the two age levels. Most important for the present discussion, the second grade experts actually recalled the chess patterns better than the sixth grade nonexperts. Given that the second grade experts rehearsed passively while the nonexperts rehearsed actively, these data suggest that children's knowledge about a particular subject can affect their memory performance independent of rehearsal or encoding strategy. Unfortunately, although a first step, these data are only descriptive, and much additional work is required to determine the effect which the developing knowledge base has upon memory performance. Despite its initial promise by focusing upon memory processing within permanent memory, however the current formulation of the levels of processing theory does not encorporate the view of a developing, changing knowledge base, nor does it suggest a particular relationship between memory processing and the structure and content of the knowledge base. Further, it does not propose a mechanism by which the knowledge base comes to change with age.

Finally, close inspection of the levels of processing formulation reveals that, like the multistore framework which it replaced, it focuses exclusively upon mnemonic memory processes such as verbal rehearsal. However, as has long been suggested by Soviet psychologists and more recently by a number of developmental psychologists such as Brown (1978) and Naus & Halasz (1978) in the U.S. much of what is important in understanding memory development seems to involve a second type of memory processing which is not strategic in that it does not involve a purposeful plan of action directed toward a specific memory goal. Instead, these more "automatic" memory processes seem to be involuntary, unplanned processes such as those involved in attention, pattern recognition, and memory inferencing. Any model of memory which is going to explain memory functioning in the growing child will have to include a discussion of both mnemonic and automatic processing, the development of each, and the interrelationships between them.

In summary then, the present paper has attempted to suggest some of the limitations of the levels of processing formulation for our understanding of the developing memory system. Empirically, this framework seems to have generated little developmental data which were not available independent of the levels of processing framework. Quite possibly, this results because the levels of processing framework is primarily an adult memory model and does not address the major issues which are involved in understanding the developing memory system. Certainly the criticisms raised in the present paper are quite general in that they are applicable to other memory frameworks as well. More specific criticisms of the levels of processing framework *per se* have been provided from an adult memory theoretical point of view by some of the other members of this panel and by Baddeley (1978), and from a developmental perspective by Naus, Ornstein and Hoving (1978), Naus and Halasz (1978), and Brown (1978). Although the approach suggested here is certainly consistent with the levels of processing view of memory in that it focuses upon memory processing as the central aspect of memory functioning, from a developmental point of view any model of memory

must also specify the mechanisms which operate in both mnemonic and automatic memory processing, and the relationship of these two types of processes to each other and to the developing knowledge base.

Thank you.

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